Algebra 1

In Algebra 1, students build upon the mathematical understandings that are addressed in prekindergarten through the eighth grade. Students will

- use symbolic reasoning to represent mathematical situations, to express generalizations, and to study relationships among quantities;
- use functions to represent and model problem situations as well as to analyze and interpret relationships;
- set up equations in a wide range of situations and use a variety of methods to solve them; and
- use problem solving, representation, reasoning and proof, language and communication, and connections both within and outside mathematics.

In Algebra 1, hand-held graphing calculators are required as part of instruction and assessment. Students should use a variety of representations (concrete, numerical, algorithmic, graphical), tools (matrices, data), and technologies to model mathematical situations to solve meaningful problems. The technologies include, but are not limited to, powerful and accessible hand-held calculators as well as computers with graphing capabilities.

I. Understanding Functions

   A. Relationships
      1. Describe independent and dependent quantities in functional relationships.
      2. Gather and record data or use data sets to determine functional (systematic) relationships between quantities.
      3. Describe functional relationships for given problem situations and write equations, inequalities, and recursive relations to answer questions arising from the situations.
      4. Represent relationships among quantities using concrete models, tables, graphs, diagrams, verbal descriptions, equations, and inequalities including representations involving computer algebra systems, spreadsheets, and graphing calculators.
      5. Make judgments about units of measure and scales within a system and between systems.
      6. Interpret and make inferences from explicit and recursive functional relationships.

   B. Linear and Quadratic Functions and Data Representations
      1. Identify and sketch the general forms of linear ($y = x$) and quadratic ($y = x^2$) parent functions.
      2. For a variety of situations, identify and determine reasonable domain and range values for given situations.
      3. Interpret situations in terms of given graphs or create situations that fit given graphs.
      4. Represent, display, and interpret data using scatterplots, bar graphs, stem-and-leaf plots, and box-and-whiskers diagrams, including representations on graphing calculators and computers.
      5. Write a linear equation that fits a data set, check the model for "goodness of fit," and make predictions using the model.

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C. Generalizations, Algebraic Symbols, and Matrices
1. Read, write, and represent very large and very small numbers in a variety of forms including exponential.
2. Use unit analysis to check measurement computations.
3. Given situations, determine patterns and represent generalizations algebraically.
4. Use symbolic representation, reasoning, and proof to verify statements about numbers.
5. Recognize and justify the relationship between the magnitude of a number and the application of specific operations.
6. Identify and use properties related to operations with matrices (addition, subtraction, and scalar multiplication) to solve applied problems.

D. Algebraic Expressions in Problem Solving Situations
1. Find specific function values and evaluate expressions.
2. Simplify polynomial expressions and perform polynomial arithmetic.
3. Transform and solve equations and inequalities, factoring as necessary in problem situations.
4. Given a problem situation, determine whether to use a rough estimate, an approximation, or an exact answer. Select a suitable method of computing from techniques such as the use of mental mathematics, paper-and-pencil combinations, calculators, and computers.
5. Use supporting data to explain why a solution is mathematically reasonable.
6. Use the commutative, associative, and distributive properties to simplify algebraic expressions.

II. Linear Functions

A. Representations
1. Determine whether or not given situations can be represented by linear functions.
2. Based on the constraints of the problem, determine the domain and range values for linear functions.
3. Translate among and use algebraic, tabular, graphical, or verbal descriptions of linear functions using computer algebra systems, spreadsheets, and graphing calculators.

B. Interpretations
1. Develop the concept of slope as rate of change and determine slope from graphs, tables, and algebraic representations.
2. Interpret the meaning of slope and intercepts in situations using data, symbolic representations, or graphs.
3. With and without using a graphing calculator, investigate, describe, and predict the effects of changes in m and b on the graph of $y = mx + b$.
4. Graph and write equations of lines given characteristics such as two points, a point and a slope, or a slope and y-intercept.
5. Determine the intercepts of linear functions from graphs, tables, and algebraic representations.

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6. With and without using a graphing calculator, interpret and predict the effects of changing slope and y-intercept in applied situations.
7. Relate direct variation to linear functions and solve problems involving proportional change.

C. Equations and Inequalities
1. Analyze situations involving linear functions and formulate linear equations or inequalities to solve problems.
2. Investigate methods for solving linear equations and inequalities using concrete models, graphs, and the properties of equality; select a method and solve the equations and inequalities.
3. Use the commutative, associative, distributive, equality, and identity properties to justify the steps in solving equations and inequalities.
4. Using concrete models for given contexts, interpret and determine the reasonableness of solutions to linear equations and inequalities.

D. Systems of Linear Equations
1. Analyze situations and formulate systems of linear equations to solve problems.
2. Solve systems of linear equations using concrete models, graphs, tables, and algebraic methods including computer algebra systems, spreadsheets, and graphing calculators.
3. For given contexts, interpret and determine the reasonableness of solutions to systems of linear equations.

III. Quadratic and Other Functions

A. Quadratic Functions
1. Given the constraints of the problem, determine the domain and range values for quadratic functions.
2. With and without using a graphing calculator, investigate, describe, and predict the effects of changes in the coefficient a on the graph of $y = ax^2$.
3. With and without using a graphing calculator, investigate, describe, and predict the effects of changes in the constant c on the graph of $y = x^2 + c$.
4. For problem situations, analyze graphs of quadratic functions and draw conclusions.
5. Solve quadratic equations using concrete models, tables, graphs, and algebraic methods that include factoring and using the quadratic formula as well as computer algebra systems, spreadsheets, and graphing calculators.
6. Relate the solutions of quadratic equations to the roots of their functions.

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B. Other Functions
1. Use patterns to generate the laws of exponents and apply the laws of exponents in problem-solving situations.
2. Analyze data and represent situations involving inverse variation using concrete models, tables, graphs, or algebraic methods as well as computer algebra systems, spreadsheets, and graphing calculators.
3. Analyze data and represent situations involving exponential growth and decay using concrete models, tables, graphs, or algebraic methods as well as computer algebra systems, spreadsheets, and graphing calculators.